

Industrial hemp: Agronomy backgrounder

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What is hemp?

- Hemp is one of the oldest fibre and food crops
- Originates from Central Asia where it was cultivated 6,500 years ago
- The Greek name of hemp, κάνναβις (kannabis), means “fragrant cane” - aroma is produced by volatile compounds (primarily terpenes)



Setting the stage - Taxonomy of hemp

- Hemp (*Cannabis sativa* L.) has two subspecies: *sativa* and *indica* that differ in content of delta-9-tetrahydrocannabinol (THC)



THC < 0.3% = Industrial hemp



THC ~ 30% = Marijuana, weed, ganja, pot, grass, Mary Jane, cannabis

Usage types



Grain type

- Short stature
- High seed yield
- Low vegetative biomass



Fibre (dual) type

- Tall or very tall plants
- Very high stem yield
- Lower seed yields

Hemp is one of the faster growing plants

July 14



July 19



Growth rate - 15 cm per day; up to 5 m

Canadian focus: hemp as a multipurpose crop



Every single part of the plant can be used



Establishing hemp as a mainstream crop for industrial applications

- Hemp fibre has great potential to be a valuable feedstock for several well established industries.

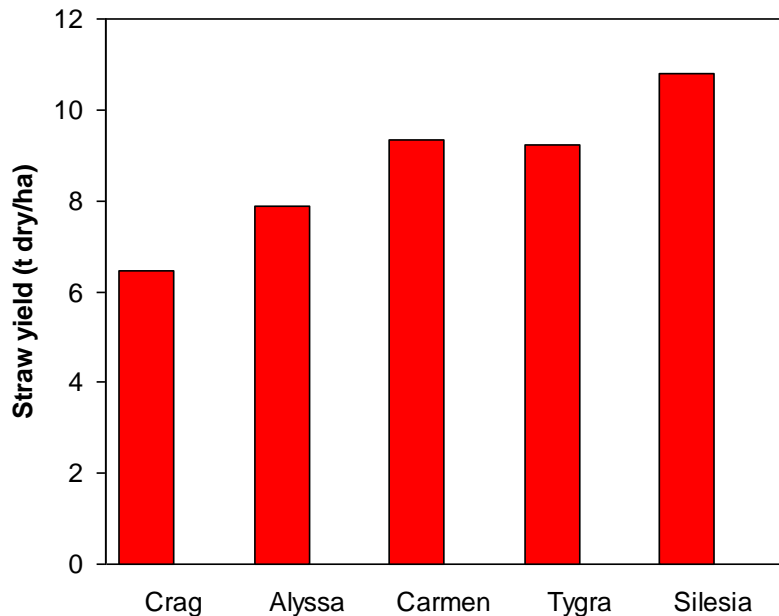
To realize potential residing within this crop InnoTech Alberta assembled a program offering solutions from **“Seed to final product “**

- Feedstock development
- Fibre processing
- Biocomposite research
- Market development



Hemp selection and breeding

- Germplasm evaluation
- Selection of top performers under AB conditions
- Maintenance breeding of fibre type cv. Silesia
- Initiation of new cultivars breeding for Alberta



InnoTech Alberta agronomy trials

Objective:

Optimization of cultivation practices for Alberta (at the Vegreville site)

- Seeding dates (mid May- mid June)
- Seeding densities (100 and 250/300 seed/m²)
- Fertilizers (cattle manure, mineral)
- N rates and forms (ammonia, urea)
- Harvest dates (for juvenile fibre)
- Herbicide resistance

InnoTech Alberta supported 4 y trials at Lethbridge, Vegreville and Falher

- Final report just filed with ACIDF

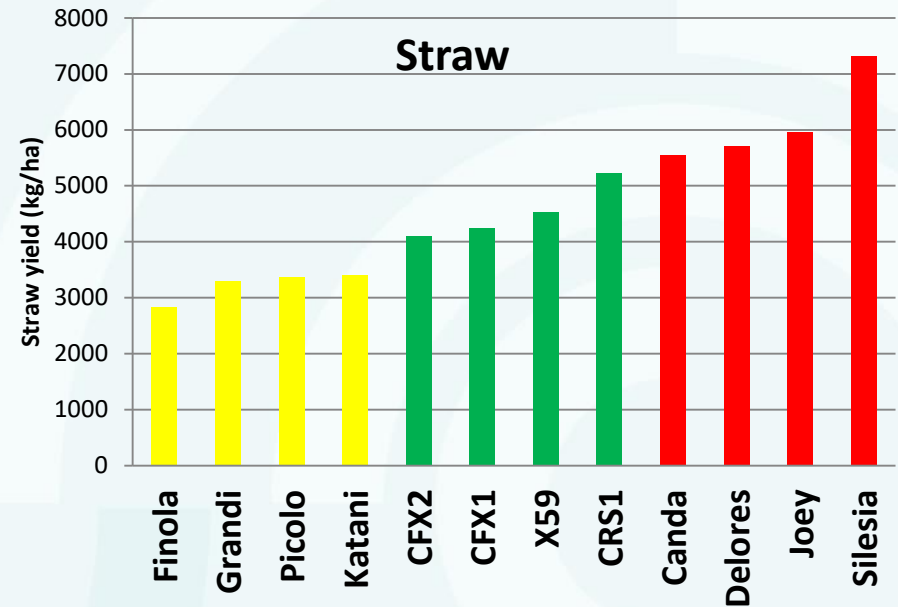
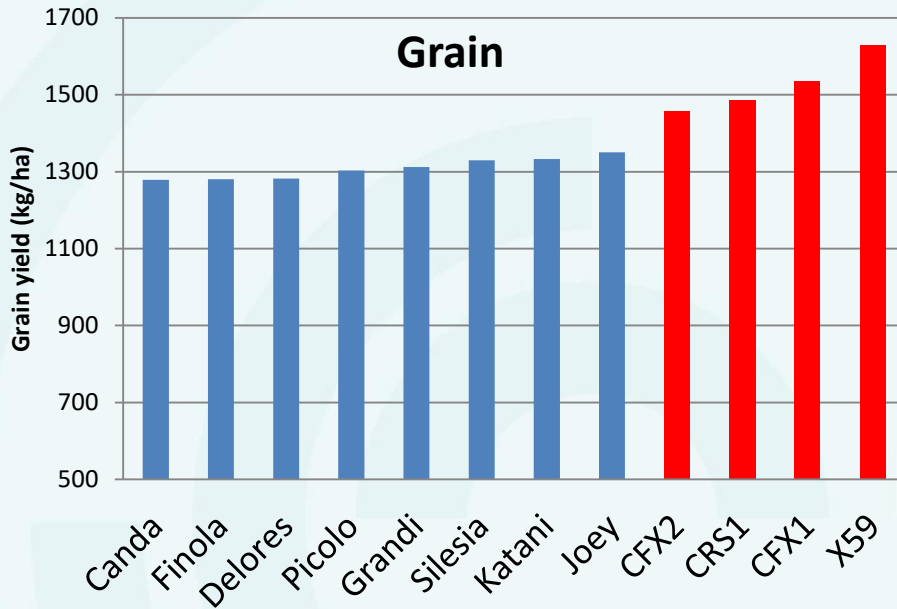
Hemp varieties grown in Alberta

- **Grain type varieties** dominate in cultivation and breeding
- **Demand for dual purpose varieties** is growing to address needs of emerging fibre industries
- Mounting **interest in high CBD** varieties

Variety	2015	2016	2017
Finola	5751.0	4525.4	6901.6
X59	2994.0	3217.4	3197.5
CFX2	969.0	828.4	233.5
GranMa	0.0	0.0	109.3
Katani	108.0	745.2	3490.3
Grandi	64.0	199.7	373.6
Piccolo	54.0	3416.8	3777.0
Other*	0.0	4.4	0.2
Total	9940.0	12937.3	18083.0

*- Silesia, Delores, CanMa

Variety selection



Grain yields:

- Medium-short varieties produced the highest yields
- Some fibre-type varieties (Silesia, Joey) yielded more than short grain-type

Fibre yields:

- Fibre-type varieties produced the highest yields
- Short grain-type varieties yielded 50% less

Field selection

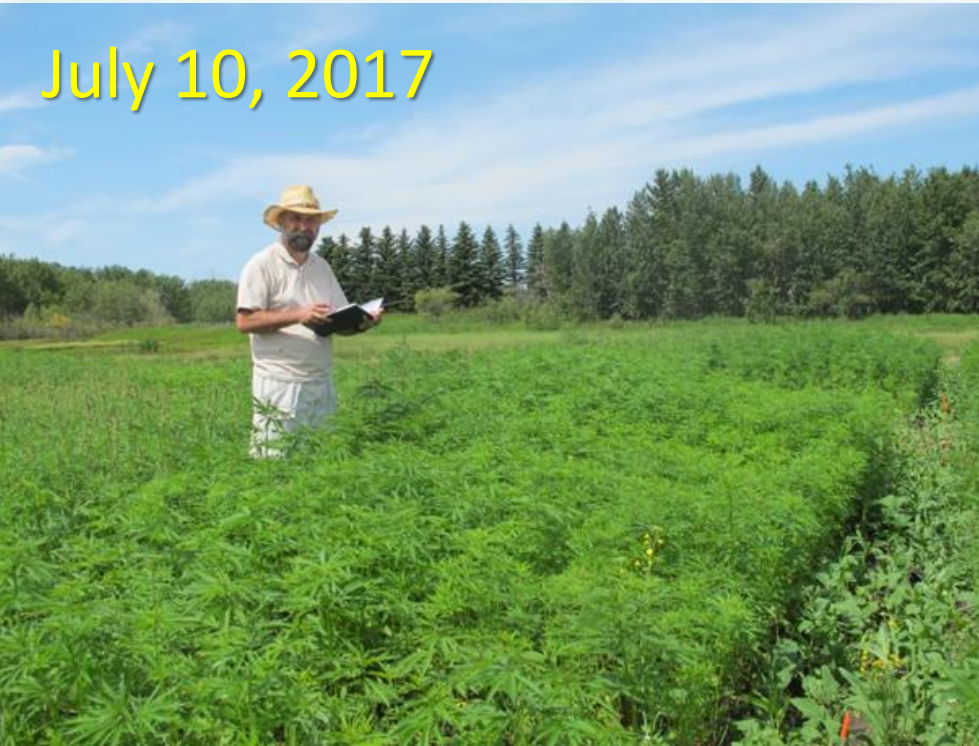
- Hemp is very sensitive to soil structure
- Yield penalty on compacted soils
- Does not tolerate soils with poor drainage



Photo credit: O. Lalonde

Fibre and grain yields are severely compromised

July 10, 2017

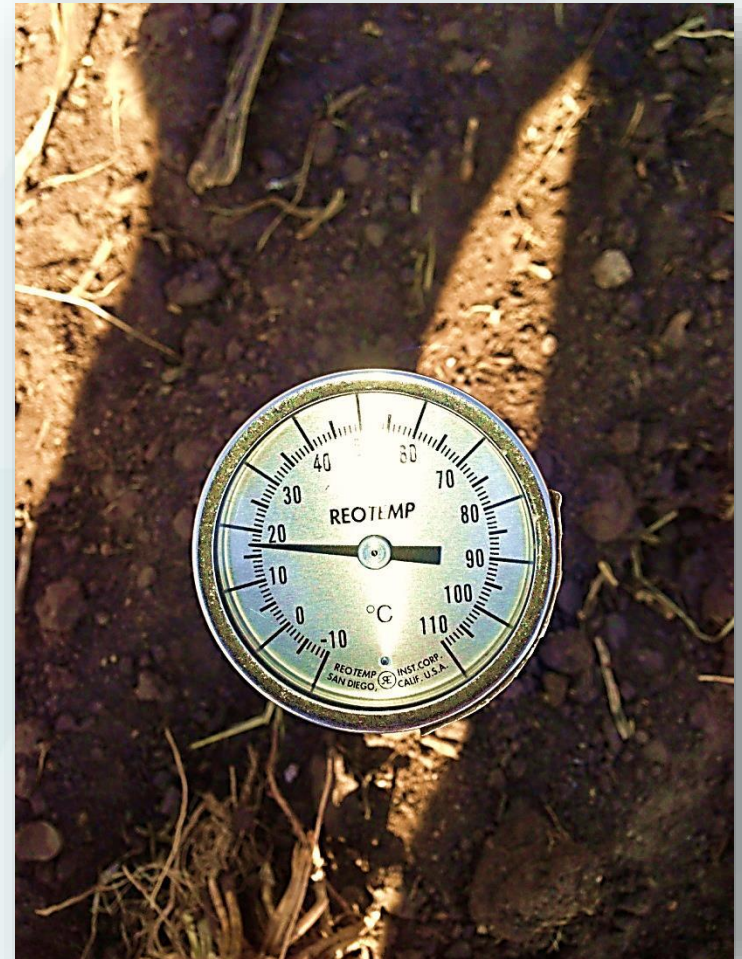


July 9, 2015



Seeding

- Seed shallow - ~ 1.5cm (or into moisture)
- 20-25 kg/ha seeding rate for grain
- 40-60 kg/ha for fibre
- Warm soils – above 8°C
- High field mortality (10-70%)
add 30% when calculating seeding rates
- Equipment – low fan speed for air seeders



High fan speed damages the seeds



3000 rpm

5000rpm

Seeding date

- Affects more yield of crop grown for fibre, less critical for grain
- Hemp is a short day plant
 - Long days (17 h) at higher latitudes delay flowering
 - Stem elongation occurs before flowering
 - Early seeding generates taller plants and more vegetative growth



Effects of seeding date on hemp performance (Lethbridge)

Seeding date	Seed yield (kg/ha)	Straw yield (kg/ha)	Harvest Index	Height (cm)	Male plants (%)	Flower (DAS)	Maturity (DAS)
Early	1884	5379	0.28	181.2	32.6	47.8	102.3
Standard	1828	4811	0.32	176.0	36.0	38.6	88.0
Late	1581	4277	0.30	166.6	37.8	34.7	78.8

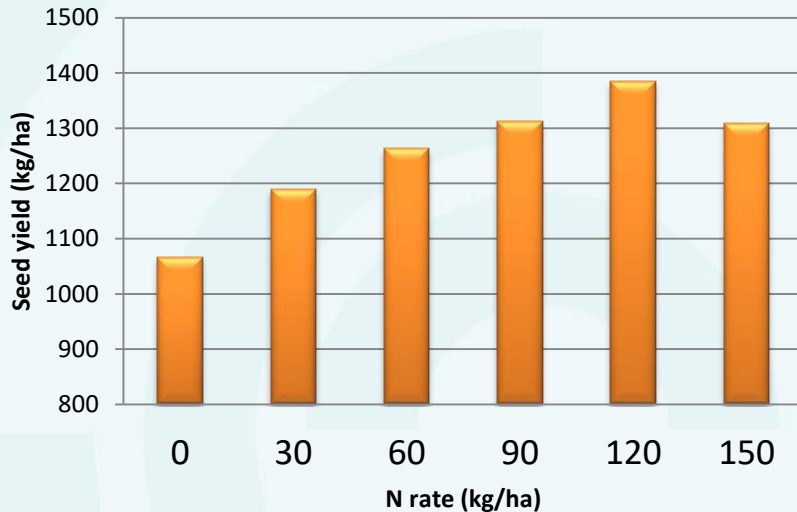
Delayed seeding – shorter plants, while grain yield not much affected (extremes mid-June to July 16)

Fertilization

- Rule of thumb for fertility recommendations
 - a high yielding and high protein spring wheat
- Hemp is sensitive to N fertilizer placement
 - side-banded, mid-row-banded or banded in a separate operation.

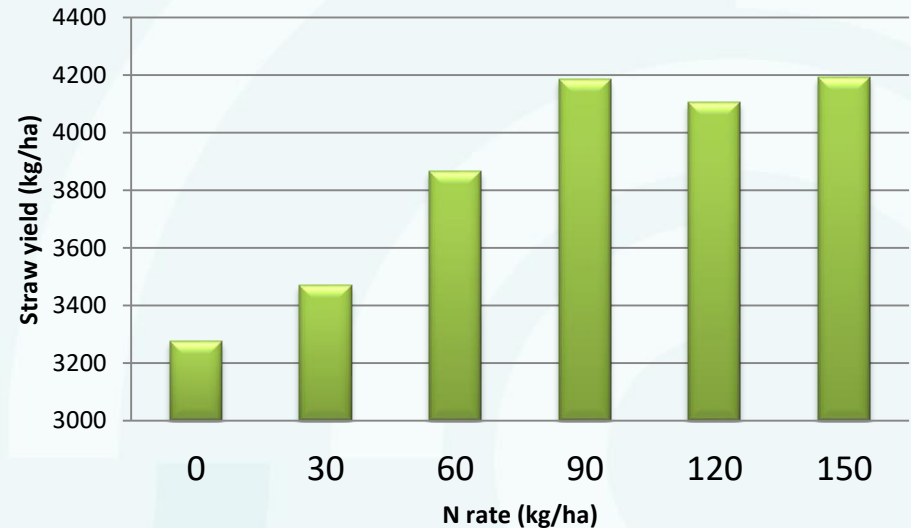


Hemp response to nitrogen fertilizer



Grain yields:

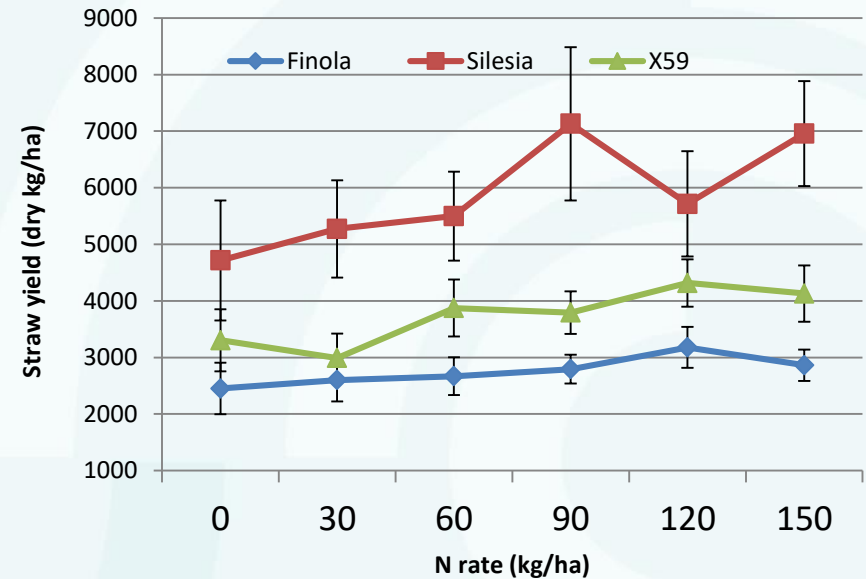
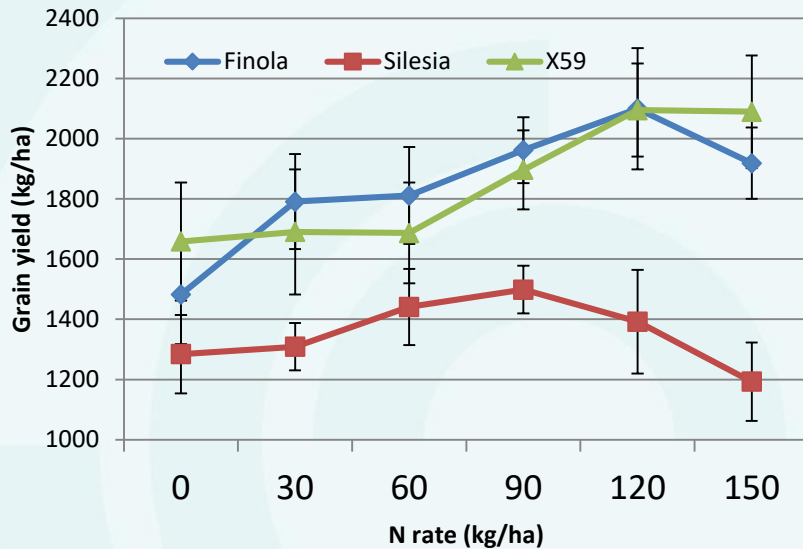
- Maximum yields at 120 N kg/ha
- Grain yield reduction at higher yields (N toxicity ?)



Fibre yields:

- Maximum yields at 90 N kg/ha
- No benefits of luxury fertilizer

Differences among hemp varieties in N fertilizer response



Grain yields:

- Grain-type varieties - maximum yields at 120 N kg/ha
- Fibre type variety - maximum at 90 N kg/ha then decrease

Fibre yields:

- Grain-type varieties - weak response to increasing N rates
- Fibre type variety - maximum at 90 N kg/ha then plateau

Weed control

- Limited selection of herbicides registered for use on industrial hemp in Canada
 - Pre-seed burn-off with glyphosate
 - Grassy weeds - Assure II (Quizalofop-p-ethy) from DuPont
 - Broadleaf weeds – Bromoxynil products (in registration)
- Cultural practices
 - Hemp is very competitive – closes canopy quickly
 - Pre-seed tillage accelerates establishment – does not like hard pan



Pests and diseases

- Sclerotinia - avoid rotation with canola
- Botrytis (grey mold)

Insects – rarely a real problem

- Bertha armyworm
- European corn borer
- Cutworms



Spring frost

- Hemp is fairly resistant to spring frost



-4.7°C on May 30



Hail injuries

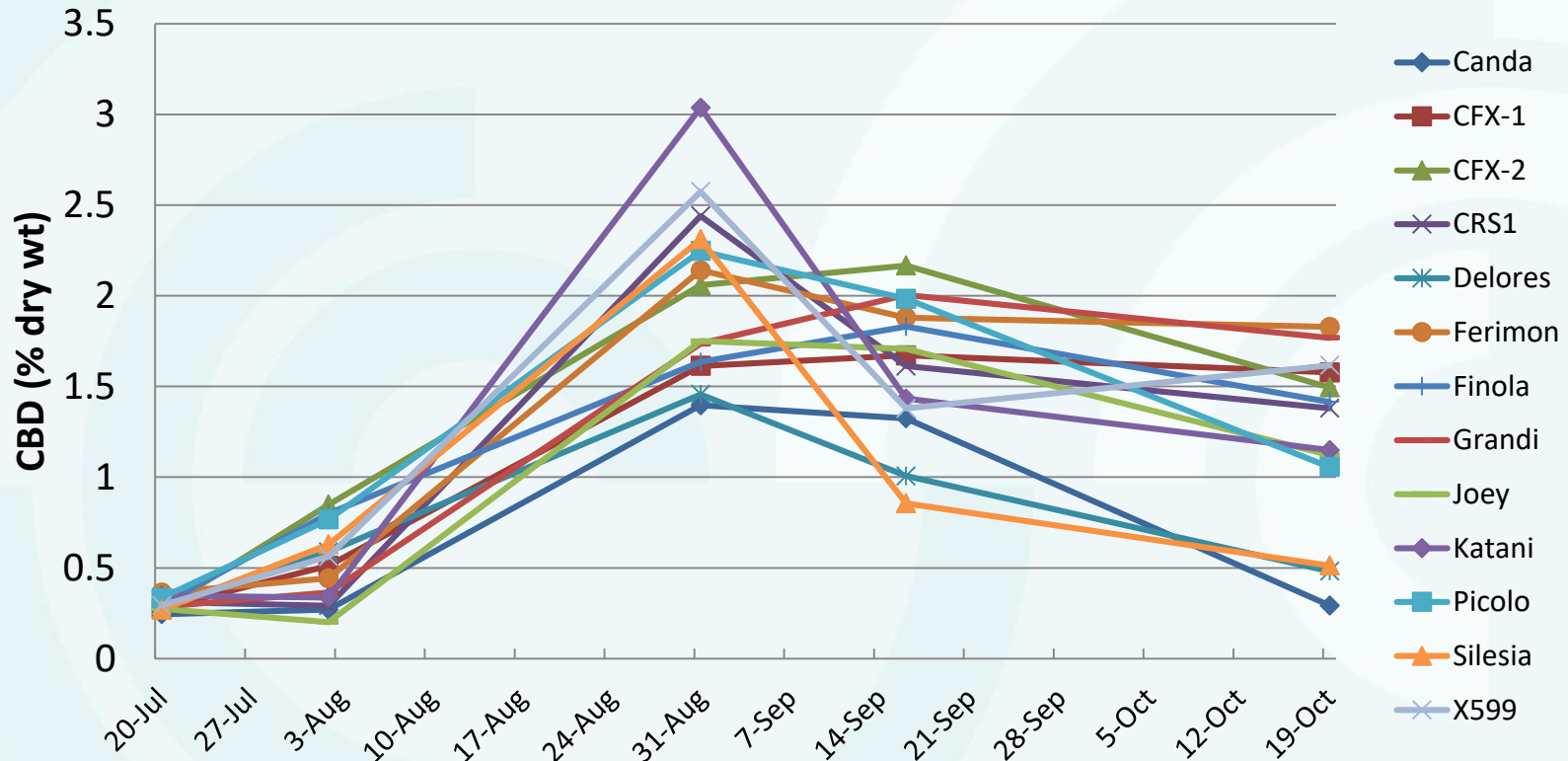
- Extent of damage depends on:
 - plant stage
 - usage type
- Symptoms - leaf shredding, stem bruising, kinking and/or breaking of stalks, loss of flower heads



Recovery from hail injury



CBD content in industrial hemp



It translates to:

- **12-20 kg/ha** of CBD or
 - **1000 - 2000 tonnes** per year
- in industrial hemp grown in Canada

Hemp – a crop like no other

- Farmers know how to grow staple crops in Alberta (wheat, canola, barley)
- Hemp is different - you have to know what are you growing for and adapt cultivation practices accordingly
- You need to apply for a licence



Thank you !

